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THE WEST INDIAN HURRICANE OF AUGUST 11, 1903.

By MAXWELL HALL, Esq. Dated Montego Bay, Jamaica, August 14, 1905.¹

I. THE HISTORY OF THE HURRICANE BEFORE AUGUST 11.

The first intimations we had in Jamaica of this great storm came from the Weather Bureau at Washington, and the following notices were posted in Kingston by the local branch of that Bureau:

August 8, 11:30 a. m.—Washington Weather Bureau notifies evidence of a disturbance ESE. of Barbados, moving N. of W.

August 8, 4 p. m.—Central Bureau, Washington, notifies that the disturbance E. of Barbados will move NW. over the Windward Islands. It is probably of dangerous strength.

August 10, 4:15 p. m.—The following has been received from the Central Bureau in Washington: Disturbance apparent; marked strength; moving N. of W. over or near Santo Domingo. Reports from Santo Domingo missing.

But as a matter of fact the hurricane moved in a straight line from Martinique to Jamaica, and then over Cayman Islands and Yucatan to the coast of Mexico where it disappeared. The following extracts are taken from the account given by Professor Garriott in the United States MONTHLY WEATHER REVIEW for August, 1903:

¹ In editing this article the Editor has, with the author's permission, substituted "hurricane" for "cyclone" as the text applies specifically to the former.

Martinique appears to be the only island of the Windward group that suffered serious damage. The vortex of the storm passed over or near that island moving in a northwesterly direction during the night of the 8-9th, unroofing several hundred houses, destroying crops, and damaging a number of sailing vessels.

Reports from Kingston, Jamaica, show that the first effects of the storm were felt on that island on the 10th, and that the main hurricane center reached the island on the morning of the 11th, causing a heavy loss of life and property. At Kingston the minimum barometer, 28.80 inches, as indicated by the barograph, occurred at 5:30 a. m. of the 11th, and at 6:15 a. m. the barometer had risen to 29.36. The anemometer cups were disabled, but the maximum wind velocity at Kingston was estimated at 65 miles an hour. The principal sufferers were the owners of banana plantations whose losses were estimated at more than £500,000. The orange, pimento, and coffee crops suffered severely; the towns of Port Antonio and Port Maria were almost destroyed, and throughout the parishes of St. Mary, Portland, St. Andrew, St. Catherine, and St. Thomas the destruction of houses, property, and plantations was appalling. Kingston, with the exception of damage to houses and warehouses on the sea front, suffered less than any other place on the island.

Later advices show that the Cayman Islands were devastated on the evening of the 11th. Captain Hunter, of the schooner *Governor Blake*, has furnished notes regarding the storm at Georgetown, Grand Cayman Island. According to his observations the 8th and 9th were clear and bright at Grand Cayman Island. The 10th was unusually warm with a NNE. wind that freshened steadily. In the afternoon the weather became cloudy and a little rain fell in the evening. From 8 a. m. to 8 p. m., local time, the barometer fell from 29.80 to 29.70 inches. At 1 p. m. of the 11th the barometer read 29.50 inches, the wind was blowing about 30 miles an hour from the NNE. and the sky was covered with thick, black clouds from the same quarter. At 4 p. m. the wind was blowing about 45 miles an hour, and at 5 p. m., with the barometer at 29.30 inches, the wind was blowing in heavy gusts at 65 miles, and the clouds hung so low that they seemed to almost touch the tree tops. At 7 p. m. the roaring of the wind began, and at 8 p. m., with the barometer reading 29.00, the wind blew at 90 miles an hour in terrific gusts that churned up the water in the harbor of Georgetown and blew out to sea or capsized several vessels. At this time, 8 p. m., it was supposed that the worst of the storm had passed, but soon the barometer began to fall so rapidly that the needle of the aneroid could be seen to move. The barometer fell until 10 p. m., when it stood at 28.30 inches with the wind blowing 110 to 120 miles an hour from ENE. to ESE. in gusts. About midnight it became almost calm for about 30 minutes, after which the wind came on fiercely from the SE. At 1 a. m. of the 12th the barometer began to rise, and at 6 a. m. it read 29.30, and at noon 29.70.

About 200 houses were blown down or unroofed, seven out of eight churches on the island were destroyed, vessels on the stocks were picked up and dashed to pieces, and of the 23 vessels in the harbor of Georgetown but one, the *Governor Blake*, was saved. Most of the crews on board perished, but no one on shore was killed.

From the cyclonic point of view this story requires the following explanatory note.

On the 11th at 5 p. m. the schooner *Governor Blake*, with Captain Hunter on board, parted her cable in Georgetown Harbor, and scudded to the south before the hurricane; and from the above account it will be seen that the *Governor Blake* got involved in the worst part of the storm, and was not thrown out, or left behind, until 1 a. m. on the 12th. She returned to Georgetown after a few days, having made several gallant rescues.

From other sources we learn that at Georgetown the hurricane raged with appalling violence from 9 to 11 o'clock, the wind veering from NE. to SE., so that the center must have passed a few miles to the south of the town at about 10 p. m.

Now the distance from Martinique to Kingston, Jamaica, is about 1095 miles; the distance from Kingston to Montego Bay is 83 miles; the distance from Montego Bay to Grand Cayman Island is 238 miles. As the center passed over Montego Bay at 9:30 a. m., we have the following velocities of the center along its course: from Martinique to Kingston, twenty miles an hour; from Kingston to Montego Bay, twenty-one miles an hour; and from Montego Bay to Grand Cayman Island, nineteen miles an hour. Hence, we shall assume that the center proceeded from Martinique to Grand Cayman Island at a uniform velocity of twenty miles an hour.

The accompanying chart, fig. 1, shows the position of the center of the hurricane at Greenwich, mean noon daily, from the 9th to the 12th, and the corresponding approximate local times.

II. THE PASSAGE OF THE HURRICANE OVER JAMAICA AUGUST 11.

We have now to consider the passage of the hurricane along almost the whole length of Jamaica, according to the following observations and notes arranged in order of time with respect to the passage of the center.

It may be here stated that the mean barometric pressure for August 11, is 29.928 inches; that all barometric pressures here given have been corrected for diurnal variation; that the readings of mercurial barometers have all been reduced to the Kew standards and to 32° F., sea level, and gravity at 45°, and that the readings of aneroid barometers have been corrected so as to make them agree with the mercurial barometers as nearly as possible.

The local reports are as follows:

(1) MORANT POINT LIGHT-HOUSE.

By Mr. W. H. BOORMAN.

At midnight the wind attained unusual force, which gradually increased until 4.30 a. m., August 11, when it became calm for about fifteen minutes, and then the wind changed to the SE.

From this we gather that the center passed a few miles south of the light-house, and that part of the calm area went over the place, so that the change of wind would have been from NNE. to SE. But there is something wrong about the time; it should have been 3:30 instead of 4:30. Indeed the nearest approach of the center to Port Antonio occurred at 4:30 a. m. and the point of nearest approach to Port Antonio was twenty miles WNW. of Morant Point. Mr. Boorman further wrote saying that he was entirely occupied in looking after the light, and this probably explains how the discrepancy occurs.

(2) HOPE GARDENS.

By Hon. WILLIAM FAWCETT.

1903.	Barometric pressure.
August 10, 5:30 p. m.	29.77 inches.
10, 9:15 p. m.	29.72
11, 3:15 a. m.	29.51
11, 4:40 a. m.	29.23
11, 4:55 a. m.	29.15
11, 5:08 a. m.	29.03
11, 5:20 a. m.	28.93
11, 5:23 a. m.	28.89
11, 5:35 a. m.	28.81
11, 5:48 a. m.	28.88

After this last observation the pressure continued to increase.

The above pressures were deduced from the aneroid readings sent me by Mr. Fawcett by adding 0.22 inch for reduction to sea level and instrumental error combined.

The Hope Gardens were very near the northern edge of the central calm; the nearest approach occurred at 5:35 a. m., or thereabouts, and the lowest pressure was 28.81 inches.

(3) RICHINGS, NEAR KINGSTON.

By Mr. CHARLTON THOMPSON.

August, 1903.	Barometric pressure.	Wind.		Notes.
		From.	Force.	
	<i>Inches.</i>			
10, 6:15 p.m.	29.77			
10, 7:50 p.m.	29.77			
10, 9 p.m.	29.74			
11, 4:30 a.m.	29.22	n.	Heavy squalls.	
11, 4:50 a.m.	29.15	n.	Heavy squalls.	
11, 5:10 a.m.	29.10	n.	Hurricane	
11, 5:20 a.m.	29.01	nw.	Hurricane	The squalls were terrific.
11, 5:30 a.m.	28.92	nw.	Hurricane	
11, 5:55 a.m.	28.97	sw.	Hurricane	A lull of ten minutes.
11, 6:10 a.m.	29.17	s.	Hurricane	
11, 6:30 a.m.	29.34	s.	Heavy squalls.	The heaviest rain was from sw. and s.
11, 6:40 a.m.	29.39	s.	Moderating.	
11, 7 a.m.	29.45	se.	Moderating.	
11, 7:15 a.m.	29.50	se.	Moderating.	
11, 7:45 a.m.	29.57	se.		
11, 8:20 a.m.	29.62	se.		

The barometric pressures were deduced from aneroid readings by subtracting 0.11 inch for instrumental error. Part of the calm area passed over Richings, and its nearest approach occurred at 5:35 a. m., which agrees with the time given by Mr. Fawcett. The lowest pressure was 28.92.

(4) KINGSTON.

By Mr. J. H. MILKE.

Date.	Time.	Barometric pressure.	Date.	Time.	Barometric pressure.
		<i>Inches.</i>			<i>Inches.</i>
August 10, 1903.	Noon	29.80	August 11, 1903	5 a. m.	29.53
Do	1 p. m.	29.80	Do	5:15 a. m.	29.26
Do	2 p. m.	29.81	Do	5:30 a. m.	29.21
Do	3 p. m.	29.80	Do	5:45 a. m.	29.11
Do	4 p. m.	29.79	Do	6 a. m.	29.01
Do	5 p. m.	29.77	Do	6:15 a. m.	29.95
Do	6 p. m.	29.76	Do	6:30 a. m.	29.93
Do	7 p. m.	29.76	Do	6:45 a. m.	29.93
Do	8 p. m.	29.75	Do	7 a. m.	29.93
Do	9 p. m.	29.74	Do	7:15 a. m.	29.04
Do	10 p. m.	29.73	Do	7:30 a. m.	29.14
Do	11 p. m.	29.73	Do	7:45 a. m.	29.23
Do	Midnight	29.73	Do	8 a. m.	29.33
August 11, 1903.	1 a. m.	29.72	Do	9 a. m.	29.47
Do	2 a. m.	29.70	Do	10 a. m.	29.54
Do	3 a. m.	29.66	Do	11 a. m.	29.66
Do	4 a. m.	29.63	Do	Noon	29.69

The above pressures were deduced from the tracings of the barograph report at Mr. Milke's store in Kings street, by adding 0.05 inch to the readings. It is an ink tracing; the line is rather thick, but the figures above can be relied on to 0.01 or so. The pen remained at the lowest reading, 28.93, longer than would seem proper considering that the place must have been near the southern edge of the calm; the tracing paper had not been carefully adjusted as to time.

(5) VALE ROYAL, NEAR KINGSTON.

By Mr. J. R. SCOTLAND.

August, 1903.	Barometric pressure.	Wind.		Notes.
		From.	Force.	
	<i>Inches.</i>			
10, 5 p.m.	29.77			Barometer steady.
11, 3 a.m.	29.60	nw.	In gusts.	
11, 3:30 a.m.	29.54	nw.	Strong	
11, 4 a.m.	29.51	nw.	Very strong.	At 4 a. m. the cloud drift was: s.-cu. ne.; c.-s. e.; c. ese.
11, 4:30 a.m.	29.40	nw.	Heavy gusts.	
11, 4:45 a.m.	29.35	nw.	Hurricane	
11, 5 a.m.	29.30	nw.	Hurricane	
11, 5:10 a.m.	29.24	nw.	70 miles per hour.	
11, 5:20 a.m.	29.21	nw.	70 miles per hour.	
11, 5:40 a.m.	28.97	nw.	70 miles per hour.	
11, 6 a.m.	28.97	nw.	Light	Lowest barometer. The lull was from 6 ^h to 6 ^h 15 ^m .
11, 6:05 a.m.	28.93	nw.	Calm	
11, 6:10 a.m.	29.04	ws.	Strong gusts.	
11, 6:20 a.m.	29.17	sw.	Hurricane	
11, 6:30 a.m.	29.41	s.	Very strong.	
11, 6:45 a.m.	29.43	se.	Strong.	
11, 7:10 a.m.	29.50	se.	Strong.	
11, 7:30 a.m.	29.55	se.	Strong.	
11, 8 a.m.	29.59	se.	Strong.	
11, 9 a.m.	29.66	se.	Brisk	
11, 10 a.m.	29.68	se.	Fresh	
11, 11 a.m.	29.70	se.	Fresh	

A mercurial barometer was used and the reading at 5 p. m. on August 10 was used to indicate the errors of the aneroids read near Kingston. The temperature that afternoon was as high as 95.5°. At 3 p. m. on the 10th the cloud drift was as follows: cirrus SE., cirro-stratus ESE., strato-cumulus NE.

(6) LINSTAD.

By Mr. DUGALD CAMPBELL.

The place of observation was a mile north of the village. The storm began at 5:30 a. m., August 11, with the wind N. by E.; the wind gradually backed to NW. at 7 a. m.; there was a calm lasting about twelve minutes, and then the wind came from the SW. and S.; at 9 a. m. all was over.

(7) CHAPELTON.

By Mr. R. CRAIG.

One-tenth of an inch has been added to the readings of the aneroid (*L*) to bring them into accordance with other readings on the night of August 10.

August, 1903.	Aneroid.	Wind.
	<i>Inches.</i>	
10, 9 p. m.	29.08	light puffs.
11, 4 a. m.	29.05	nw.
11, 6 a. m.	29.03	w.
11, 7 a. m.	29.01	w. by s.
11, 7:40 a. m.	29.01	s. by w.
11, 8 a. m.	29.02	s.
11, 8:30 a. m.	29.03	s. by e.
11, 9 a. m.	29.03	se.
11, 10 a. m.	29.04	se.
11, 11 a. m.	29.05	se.

The wind was strongest from 7:40 to 8:30 a. m.

(8) LLANDOVERY.

By Mr. A. J. WEBB.

1903.	Barometric pressure.
August 11, 0 a. m.	29.87 inches.
6 a. m.	29.75
6:50 a. m.	29.58
7:05 a. m.	29.53
7:14 a. m.	29.48
8:15 a. m.	29.15
8:35 a. m.	29.33
10 a. m.	29.71
Noon.	29.83

An aneroid was used. Between 7:14 and 8:15 a. m. the storm was at its height, but a broken window prevented the readings being taken in that interval. If a curve be drawn representing the fall of pressure with the time, it will be found that the lowest reading was 29.2 a little before 8 a. m. The strongest wind was from the NE.

(9) HANBURY, NEAR SHOOTERS HILL, MANCHESTER.

By Mr. S. T. SCHARSCHMIDT.

August, 1903.	Barometric pressure.	Wind.	Notes.
		From. Miles per hour.	
	<i>Inches.</i>		
10, 6 p. m.	29.80		
10, 10 p. m.	29.80		
11, 4 a. m.	29.69		
11, 6 a. m.	29.63		
11, 6 a. m.	29.56	wnw.	19
11, 7 a. m.	29.43	w. by n.	77
11, 8 a. m.	29.35	w. by n.	14
11, 9 a. m.	29.48	sw.	77
11, 10 a. m.	29.56	s.	25
11, 11 a. m.	29.64	sse.	10
11, noon.	29.68		
11, 1 p. m.	29.69	se.	2

The barometric pressure was deduced from the readings of an aneroid; 1.77 inches was added for reduction to sea level and instrumental error. The force of the wind was estimated by Beaufort's scale; the corresponding velocities are given.

(10) CHRISTIANA.

By Mr. T. C. GARRETT.

Wind and rain set in from the NE. at 11 p. m. on the 10th. At 5 a. m. on the 11th the wind was N. It gradually backed to NW. at 7 a. m. Then there was a lull for a quarter of an hour, when the wind recommenced from the W. At 8 a. m. the wind was SW., at 9 a. m. S., and finally SE. The strongest winds were from the N. and SW.

Fine cirrus bands were seen stretching N. and S. across the sky on the evening of the 10th.

(11) KEMPSHOT OBSERVATORY.

By Mr. A. MAXWELL HALL.

August, 1903.	Barometric pressure.	Wind.	Notes.
		From. Force.	
	<i>Inches.</i>		
11, 5 a. m.	29.659	nw.	
11, 7:45 a. m.	29.434	nw.	
11, 8:15 a. m.	29.292	nw.	Hurricane
11, 8:45 a. m.	29.097	sw.	Hurricane
11, 10 a. m.	29.323	s.	Hurricane
11, 10:30 a. m.	29.415	s.	
11, 11 a. m.	29.522	s.	
11, 11:30 a. m.	29.579	se.	
11, noon.	29.650	se.	
11, 1 p. m.	29.705	se.	

The barometer used was a mercurial standard and the readings and the times may be regarded as thoroughly reliable, but the observer was quite inexperienced in cyclonic matters and paid more attention to the safety of the doors and windows of the houses than to the scientific part of the phenomenon, so that the very lowest readings were entirely omitted.

(12) BRANDON HILL, NEAR MONTEGO BAY.

By Mr. MAXWELL HALL.

August, 1903.	Barometric pressure.	Wind.	Notes.
		From. Miles per hour.	
	<i>Inches.</i>		
10, 2 p. m.	29.874	ene.	15 Clear, very fine.
10, 4 p. m.	29.847	ene.	15 Clear, very fine.
10, 6 p. m.	29.837	ene.	3 Clear, a little cirrus se.
11, 6 a. m.	29.686	n. by e.	10 Rain, and scud flying fast overhead.
11, 7 a. m.	29.609	n. by e.	20 Heavy rain squalls.
11, 8 a. m.	29.520	nne.	50 Heavy rain squalls.
11, 8:15 a. m.	29.478	nne.	60 Heavy rain squalls.
11, 8:30 a. m.	29.427	nne.	60 Heavy rain squalls.
11, 8:45 a. m.	29.351	nne.	60 Very heavy squalls.
11, 9 a. m.	29.16	nne.	70 Very heavy squalls.
11, 9:15 a. m.	28.93	calm.	0 A break in the clouds; clouds ne. by n.
11, 9:30 a. m.	28.942	calm.	0 Plenty of light; clouds e. by s.
11, 9:37 a. m.	28.948	calm.	0 Clouds ssw.
11, 9:42 a. m.	28.991	ssw.	15 No rain.
11, 10 a. m.	29.173	s.	60 Wind steady; no rain.
11, 10:15 a. m.	29.273	s.	40 Wind steady; no rain.
11, 10:30 a. m.	29.359	s. by e.	10 Wind steady; no rain.
11, 11 a. m.	29.452	sse.	10 Rain.
11, noon.	29.602	se. by s.	10 Rain.
11, 1 p. m.	29.686	se. by s.	5 Light rain.

The barometer used was a mercurial standard. The very heavy squalls were estimated up to 80 miles an hour. The calm lasted 27 minutes, from 9:15 to 9:42 a. m. The readings at 9 and 9:15 a. m. were taken with an aneroid, as it was too dark to read the standard in the closed veranda. The temperature in the open veranda was 79° at 6 a. m. and again at 11 a. m.; it fell to 76° in the closed veranda at 9 a. m.

(13) SAVANNA LA MAR.

By Mr. J. F. BRENNAN.

August, 1903.	Barometric pressure.	Wind.	Clouds.	Notes.
		From. Miles per hour.	Kind. From.	
	<i>Inches.</i>			
10, 7 a. m.	29.89	ne.	12 1 cirrus.	ne. Squally.
10, 10 p. m.	29.82	ne.	12 10 nimbus.	? Rain.
11, 7 a. m.	29.70	ne.	12 10 cumulo-nimbus.	nne. Squally.
11, 8 a. m.	29.59	ne.	12 10 nimbus.	n. by e. Rain.
11, 9:30 a. m.	29.46	nne.	20 10 cumulo-nimbus.	nw. Rain.
11, 10:30 a. m.	29.47	sw.	20 10 cumulo-nimbus.	sw. Rain.
11, 11 a. m.	29.52	ssw.	30 10 cumulo-nimbus.	ssw. Rain.
11, 11:30 a. m.	29.57	se.	35 10 cumulo-nimbus.	se. Rain.
11, noon.	29.64	se.	35 10 cumulo-nimbus.	se. Rain.
11, 12:30 p. m.	29.67	se.	20 10 cumulo-nimbus.	se. Rain.
11, 1 p. m.	29.68	ese.	30 10 cumulo-nimbus.	se. Rain.
11, 5 p. m.	29.76	se.	30 10 cumulo-nimbus.	se. No rain.
11, 7 p. m.	29.79	se.	20 10 cumulo-nimbus.	se. Squally.

The barometric pressures were deduced from aneroid readings. The velocity of the wind was estimated.

III. GENERAL RESULTS OF THIS STUDY.

From the backing of the wind at Richings and at Vale Royal it appears that the center must have passed a little north of these places; also a little north of Linstead, Chapelton, and Christiana, south of Llandoverly, but central over Brandon Hill, Montego Bay. A straight line from near the Morant Point light-house to Montego Bay satisfies these conditions, as shown in the accompanying chart, fig. 2.

From the observations made at Brandon Hill it appears that the worst part of the storm lasted for two hours,² from 8 to 10 a. m., and hence the computed diameter of the destructive area of the hurricane was not more than 40 miles. If, therefore, we draw two lines on the chart parallel to the course of the center, twenty miles north and south of the course respectively, the area of destruction will be bounded by these lines.

We now see why the south coast of Jamaica from Old Harbor to Savanna la Mar did not suffer; it was outside the limit.

Again, Montego Bay was fairly sheltered from the northerly and southerly winds, so that the town was not injured; and Lucea was sheltered from the northwesterly and southerly winds and also escaped; but all along the north coast from Manchioneal to Falmouth the wind was tremendous, and there was considerable loss of life among the falling trees and houses. In many low-lying places the wind drove the sea ashore; and there is reason to suppose that had the center been moving slowly instead of at the high rate of twenty miles an hour, there would have been appalling loss of life from the invading sea.

At Kingston and Port Royal the storm began between 2 and 3 a. m. with the wind, it is said, from the NE.; about 5 a. m. it shifted to the W.; at 5:30 a. m. there was a lull; the barometer began to rise, and the wind worked round to the SE. Port Royal did not greatly suffer; and the chief damage in Kingston was confined to the telegraph poles and wires. The Daily Gleaner gave the following account of the appearance of the city at 6 a. m. :

At 6 o'clock Kingston presented a woful spectacle. The streets were utterly deserted. In some quarters there was not a sign of life. But on every hand stood out the evidences of the night's terrible visitation. Huge trees, landmarks of a score of years many of them, lay across the streets and lanes. Roofs of houses, broken windows, and fallen wires appeared in every thoroughfare. Right away up Orange street every telephone pole was down. Like so many broken masts they lay across the street, their net-work of wires in a tangled mass, all within reach of the hand. In some places the telephone, electric light, and tramway wires were mixed in inextricable confusion. All over the city it was the same. Streets and lanes were blocked by broken trees, fallen telephone poles, and other débris.

At Port Antonio the wind had been from the N. during the 10th, and it increased in violence until 3 a. m. on the 11th, when it blew a hurricane which lasted till 5:30 a. m. The wind was very violent; all the small and poorly built houses collapsed as a matter of course; several solidly built buildings, such as the hospital and the Tichfield School, were more or less destroyed, and of the five or six steamers in the harbor four or five were driven ashore. It may be inferred that full hurricane force was reached from the statement that trees were not merely blown down; they were uplifted with their roots and hurled along.

There was no lull. The nearest approach of the center to Port Antonio was fifteen miles, and according to the observation made at Brandon Hill the diameter of the calm area must have been about ten miles, so that at the nearest approach Port Antonio must have been ten miles from the northern edge of the calm area. No doubt the wind veered to NE. when the hurricane was strongest, and then to E. and SE.; but I have no note on this subject.

At Manchioneal the wind was equally strong. It com-

menced from the N., then veered NE., E., and SE., when it was said that "nothing could stand before its fury." The small town was destroyed. The houses, with very few exceptions, were either blown down or washed away by the waves, which came 100 yards ashore, and there was considerable loss of life.

Returning westward, Port Maria also suffered greatly. On the 10th the wind was from the N., and as night came on the wind increased. At 4:30 a. m. on the 11th the hurricane struck the town, and at 6:30 a. m. it was at its height. The sea rose, and in an incredibly short time it had swept over the entire eastern portion of Main street, across the Warner swamp land into Warner street, a thing unparalleled in the history of this ancient town.

At Falmouth the advance of the sea was so rapid that the correspondent of the Gleaner called it a "tidal wave," meaning, no doubt, one of those terrible waves due to earthquake shocks which often devastate the shores of countries liable to earthquakes. He writes:

The whole seaboard was devastated both by the hurricane and the tidal wave, which rose some twenty feet and rushed with a deafening roar up the streets, carrying fishing canoes and other small craft more than one hundred yards up the streets.

From inquiry made on the spot it appears that the sea rose somewhat rapidly and then rushed ashore, so much so, that Inspector Toole had great difficulty in removing his family from his quarters in the old barracks, which as the sea rose he considered untenable, but there was no such "tidal wave" as described above.

A very large number of poorly built houses were destroyed, a great deal of damage was done to more substantial houses, and as many as fifteen sloops were driven ashore or sunk.

The wind veered from NW. around by N. to E. and SE.; the storm was at its height between 8 and 9 a. m.; the nearest approach of the center was seven miles, so that Falmouth was just outside the northern edge of the central calm, and of course there was no lull.

From these few and brief descriptions of the storm at different places some idea may be formed of the enormous amount of damage done within the storm area; all the large plantations of cocoa palms along the north side and at the east end were destroyed; all banana cultivations, wherever situated, were ruined for a time; and throughout the length and breadth of the island a large proportion of fruit, pimento, and coffee trees were damaged or destroyed.

The record of the tide gage at Port Royal is very interesting; by comparing the height of the water on the 11th with the corresponding heights on the 10th and 12th,³ we get the results given in the following table:

		Inches.
August 11,	0 a. m., water level	1 below mean.
	1 a. m., water level	7½ below mean.
	2 a. m., water level	4 below mean.
	3 a. m., water level	½ below mean.
	4 a. m., water level	6½ above mean.
	5 a. m., water level	11½ above mean.
	6 a. m., water level	13½ above mean.
	7 a. m., water level	9 above mean.
	8 a. m., water level	5½ above mean.
	9 a. m., water level	6 above mean.
	10 a. m., water level	6½ above mean.
	11 a. m., water level	4 above mean.

It then fell to the mean again as before midnight.

It, therefore, appears that an advancing hurricane produces a wave in the height of the level of the sea; the height first falls when the hurricane is 80 or 100 miles away, and then rises, the greatest rise taking place at the time of nearest approach of the center; in this particular instance, the fall below mean was seven inches and the rise above mean thirteen inches.

Now, during the evening and night of August 10, the wind

²At Port de France, Martinique, it also lasted two hours.

³To eliminate the small tidal effect.

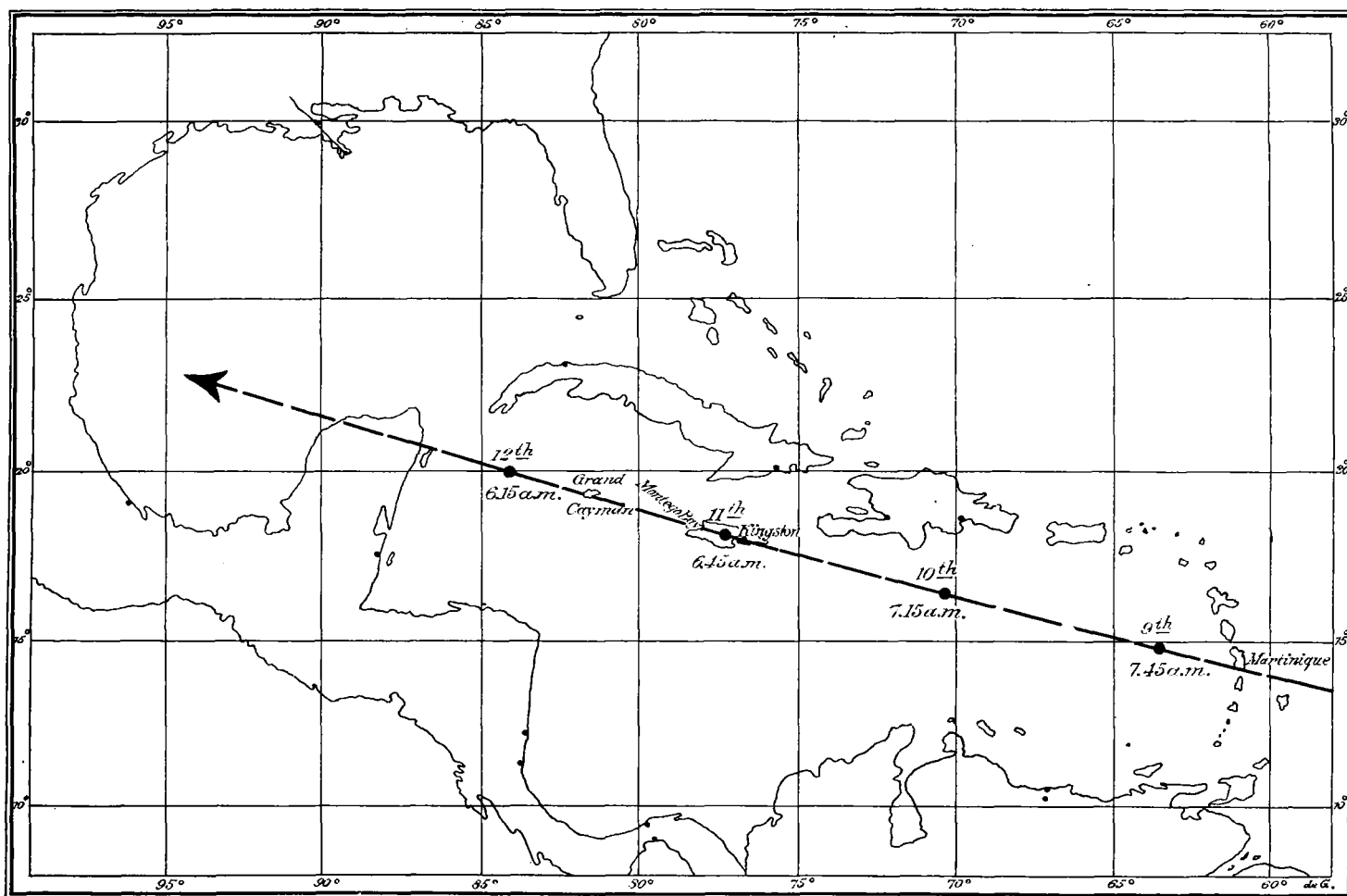


FIG. 1.—Position of the center of the hurricane from August 9 to 12, 1903, at Greenwich mean noon, with the approximate local times.

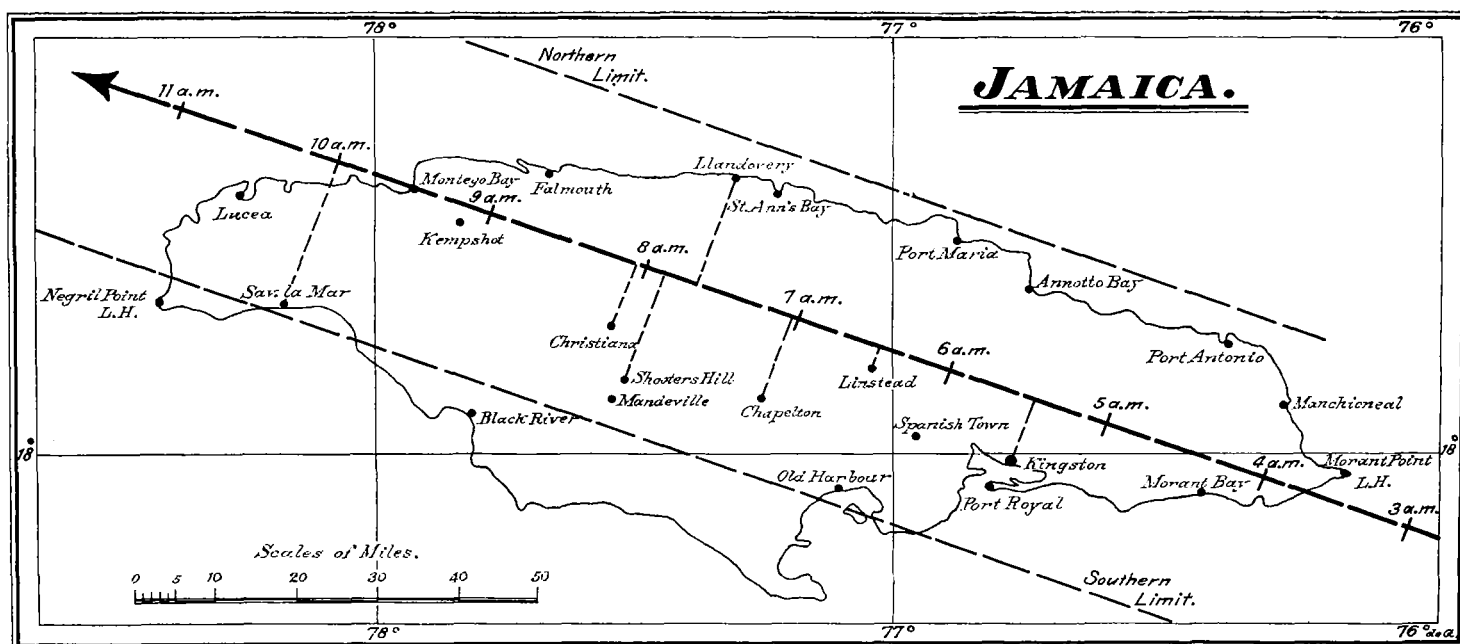


FIG. 2.—Positions of the center of the hurricane on August 11, 1903, for each hour of Kingston mean time.

set in from the N. at Manchioneal, Port Antonio, Port Maria, Falmouth, and no doubt at many other places on the north side of the island; this direction is in accordance with the cyclonic theory, but at Christiana, Montego Bay, and Savanna la Mar, the wind was NE.; so that the wind at these places had not yet felt the influence of the cyclonic center. Up to 11 p. m. on the 10th the wind was NE. at Christiana, when the center was 180 miles away, and we do not know when it backed to N.; if this was at 1 a. m., the center would have been 140 miles away.⁴

Now, as the wind had been N. nearly all day at Port Antonio, when the course of the center was much farther away, it is quite clear that the winds at places on the northern shore were far more susceptible to cyclonic influence than at places like Christiana, Montego Bay, and Savanna la Mar, where ranges of hills and forests interfered with the surface current; any local system of storm warning should embody this fact.

With regard to the NE. winds at Kingston and Port Royal at the commencement of the storm, it may be said that the wind at Kingston generally does show some irregularity as a hurricane approaches, due, I believe, to the Port Royal and Blue Mountain ranges, which rise to an average elevation of 5000 feet at a distance of not more than ten miles from Kingston, and protect the city and the harbor from all strong northerly winds.

The next point for consideration is the fact that the wind was much stronger on the north than on the south side of the island at the same distance from the center and within the storm area. It has been already noticed that the open sea allowed light winds to be readily affected by the cyclone at a great distance, but we are now considering the strength of the wind when near its full force.

Thus, at 6 a. m., there should have been a SSW. wind at Port Royal fully equal to any experienced on the north side of the island, which was not the case; and again at Savanna la Mar the wind never rose above 35 miles an hour. How is this to be accounted for?

The cyclonic theory no doubt presents many difficulties. Take, for instance, the motion of the calm area at the center; this is not produced by combining the motions of translation and rotation, for in that case the lowest pressure would not coincide with the calm area, which it invariably does. In the chart of this hurricane we could easily find a line south of the central line, where the wind was blowing from WNW. at twenty miles an hour; combining this with the velocity of the center toward the WNW. of twenty miles an hour, there would be a belt of calm far removed to the south from the belt of lowest pressure; but this was not the case.

Let *C* be the center of a cyclone, and let *A* and *B* be the positions of portions of the moving air in front and in rear of *C*, respectively:

A, C, B;

then we are to suppose that *C* was once at *B*, and that it will shortly be at *A*, and that the area of lowest pressure has proceeded from *B* to *A* with a wave-like motion, without thrusting the air in front of it or dragging it behind.

Dr. W. N. Shaw, Secretary of the Meteorological Committee of the Royal Society, has shown that if each portion of air within a cyclone simply moves at any instant in accordance with its position and distance from the center at that instant, then the effect of the motion of the center is to make the air (in such a cyclone as we are now considering) sweep in from the north to the central line and then turn sharply around the center, W., S., and SE., while the air south of the central line hardly approaches or even moves away from the center.

Consequently the mountain ranges referred to above and the ranges all along the middle of the island may have great effect

in diminishing the strength of W., S., and SW. winds at places south of the central line, especially when the motion of the center is large.

JAPANESE METEOROLOGICAL SERVICE IN KOREA AND MANCHURIA.

By Prof. Y. WADA. Dated Chemulpo, Korea, August, 1905.

[Translated from the French manuscript, with notes by Dr. S. Tetsu Tamura.¹]

Since the beginning of the recent Russo-Japanese war, our government, feeling the necessity of a special meteorological service along the coasts of Korea, established at first five meteorological stations, and has since then increased these to the number of nine stations, the approximate geographical coordinates of which are as follows:²

TABLE 1.—*Stations with approximate geographic coordinates.*

Localities.	Latitude N.	Longitude E.	Height.
	° /	° /	Meters.
1. Fusan	35 6	129 3	23
2. Mokpo	34 41	126 4	8
3. Chemulpo....	37 29	126 37	70
4. Wonsan	39 9	127 26	3
5. Yongampo....	39 56	124 22	5
6. Taireu	38 55	121 34	5
7. Yinkow	40 40	122 14	3
8. Mukden	41 48	123 23	57
9. Josin	40 40	129 20	4

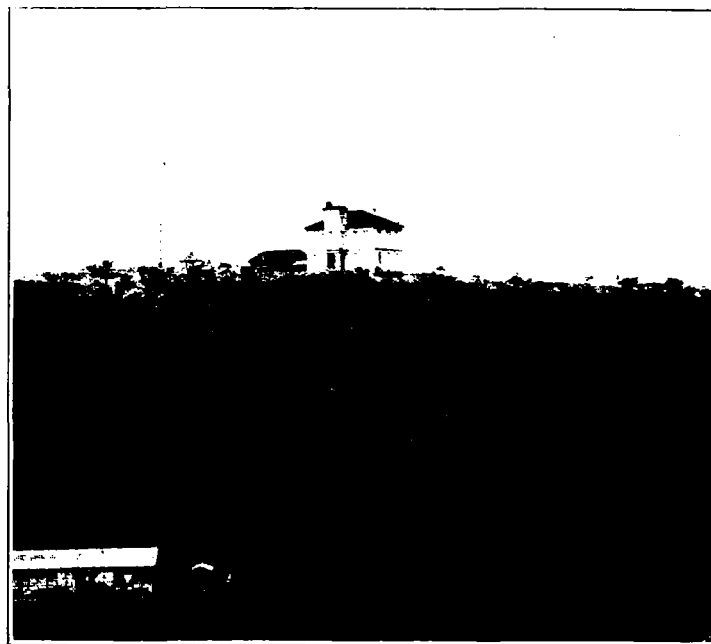


FIG. 1.—The Chemulpo Meteorological Observatory.

Besides the stations above mentioned, there are four others which are at the same time marine semaphore stations.

The Chemulpo Meteorological Observatory is of the first order, and the other eight stations are of the second order

¹ Ever since 1879 Professor Doctor Wada has been connected with the meteorological service in Japan, and has been for many years the chief of the service of predictions in the Central Meteorological Observatory. Japan owes a great deal to him for his important investigations of meteorological conditions in Japan and for the organization and completion of our weather service. At the beginning of the recent Russo-Japanese war Professor Wada was entrusted by the Japanese Government with the organization of a similar system in Korea and Manchuria, and is now completing the work as the chief of that service.—*S. T. T.* [We are pleased to be able to add his photograph to this note.—*Ed.*]

² Three new stations, at Port Arthur, Nikoloisk, and Alexandrosk, were added at the moment of sending this note.

⁴ Corresponding to a fall below mean pressure of 0.17 inch.